NIPCC Copy #3

CHASE ECONOMETRIC ASSOCIATES, INC

PB 207 200

PHASE II OF

THE ECONOMIC IMPACTS OF MEETING EXHAUST EMISSION STANDARDS, 1971-1980

PART ONE

EXECUTIVE SUMMARY

PREPARED FOR

THE COUNCIL ON ENVIRONMENTAL QUALITY

BY

CHASE ECONOMETRIC ASSOCIATES, INC.

DECEMBER 1, 1971

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
Springfield, Va. 22151

I. Introduction

This report has been prepared to estimate the economic effects of mobile source emission controls on the automobile industry. In this report we are not concerned about the addition of pollution control equipment to automobile manufacturing plants. Instead we concentrate exclusively on the effects which emission controls will have on the cost and price of automobiles, and hence on shipments and employment of the automobile industry and its supplier industries.

This executive summary follows the same logical outline as Part III of the complete report, with key tables included but much of the explanatory and numerical detail omitted. Since the complete study by necessity follows a very distinct and somewhat rigid progression, the summary material presented here follows this same order, which may differ slightly from the order found in the other reports on pollution control. In brief, the analysis which we use is based on the following pattern:

1. We use the cost data supplied by The Council on Environmental Quality for mobile source emission controls. These data are available on an annual basis and cover the original cost of the required equipment. Replacement and maintenance costs are not considered separately as they are likely to be covered by warranty.

2. We estimate the change in price which will occur because

of the increase in pollution control costs. In particular we examine whether auto companies raise their prices by an amount greater than, equal to, or less than, the cost increases. We then quantify these pass-on percentages by each size-price classification of car.

3. We estimate equations which are used for predicting the share of the total market for each size-price classification. These shares are a function of relative prices for different sizes of cars and various macroeconomic variables. If we can estimate the proportion of the cost which is passed along, and hence the new relative price structure of cars by size-price classification, we can then predict the change in relative shares which will occur because emission control equipment is added.

4. We use the Chase Econometrics macroeconomic model to estimate the total level of car sales with and without emission control equipment. These estimates are then used in conjunction with the relative share equations to generate predictions of the actual number of cars sold by size-price classification.

5. We use the Chase Econometrics Inter-Industry Forecasting Model to generate predictions of sales, profits, employment, and shipments for all industries which are major suppliers to the automobile industry as well as the auto industry itself.

6. We have repeated these calculations, as requested, for a rise in costs which are 30% less and 30% more than the expected

increments estimated by The Council on Environmental Quality. However, these calculations have been relegated to the Part III of the report and the Appendix. For the most part the non-linearities inherent in the system are negligible for changes of this order of magnitude, and hence the basic conclusions can be reproduced with the appropriate scale factor of ± 30%.

II. Cost Data

The estimated investment costs for alternative mobile source emission controls for the period 1967-1977 are given in Table I. The costs for the period 1967-1972 are already known and in fact have been included in the prices of automobiles to date. As can be seen from Table I, these costs have already cumulated to $34.50 per car. The 1973-74 incremental cost of $48.00 is already a firm figure, since planning of these devices is virtually complete. The 1975-77 costs have a much greater range of uncertainty attached to them, which is why we have repeated the calculation with figures of ± 30%. While a considerable amount of research has already been undertaken by both automobile and chemical companies, the problem of finding a catalytic unit which will last for 50,000 miles has not yet been solved.

After these emission control devices have been added, it is unlikely that future pollution control equipment will be required for automobiles during the next decade. However,

Table I

ESTIMATED INVESTMENT COSTS FOR ALTERNATIVE MOBILE SOURCE EMISSION CONTROLS 1967-1977

Autos and Light Duty Trucks

Model Year	Controls Added	Cost Per New Vehicle (Dollars)	Cumulative Costs (Dollars)
1967	None	0.00	0.00
1968-69	Closed PCV system (above cost of open system). Carburetor changes. Ignition timing changes. Inlet air temperature control.	5.40	5.40
1970	Additional carburetor changes. Idle control solenoid. Ignition timing changes.	7.40	12.80
1971	Evaporative emission control. Improved idle control solenoid with overheat protection (above '68-'70 costs) including transmission spark control. Lower compression ratios. Additional carburetor changes.	19.70	32.50
1972	Valve and valve seat changes for unleaded gasoline.	2.00	34.50
1973-74	Exhaust gas recirculation for NO_x control, fixed orifice system. Speed controlled spark advance.	48.00	82.50
1975	Catalytic oxidation of exhaust HC and CO (includes long-life exhaust system). Unitized ignition systems for 50,000 mile service-free performance. Air injection for catalytic unit needs.	164.00	246.50
1976-77	Dual catalyst units for HC, CO oxidation and NO_x reduction (additional cost above previous controls which are supplanted). Modified manifold reactors to reduce catalyst load.	105.00	351.50

the automobile and the internal combustion engine will undoubtedly continue to receive a great deal of unfavorable comment from the ecologically minded public, particularly in the field of urban transportation. Rotary engines (such as the Wankel engine), mini-cars which could be electrically powered and used only for short trips, turbines, and extended mass transit systems could reduce the market for automobiles and IC engines far more than will price increased due to emission control devices. Furthermore, as discussed below, the increased prices associated with these controls is likely to spawn a new class of sub-sub-compacts, which may not be produced by existing auto companies and in any case would materially alter the present mix of car production facilities.

We were also given estimates by The Council on Environmental Quality on the additional costs associated with increased maintenance charges and decreased fuel efficiency, but we have not processed those figures for use in this report. First, in order to ensure that the emission control equipment is in good working order, auto companies are likely to include any required maintenance or adjustments under warranty. This would add to the initial purchase price of the car but not its annual operating expense. Second, there is no a priori relationship between fuel efficiency and number of new cars purchased. The average driver consider increased fuel costs

to be higher operating costs, in which case he would use less cars and more mass transit. He might also reduce the number of miles driven per year and hence keep each car longer. On the other hand, petroleum companies might lower the price of gasoline or restructure their refining or marketing structures. Until these interdationships have been explored in some detail, it is not useful to speculate on the effect which decreased fuel efficiency will have on new car sales.

III. Cost-Price Relationship

One of the most difficult and sophisticated parts of this study involves the translation of costs to prices. In a competitive industry, prices would originally rise by the full amount of the cost increase, demand would slacken, some firms would go out of business or reduce production, and after some time a clearly definable new equilibrium position would be reached. The U.S. automobile industry, however, is the classic textbook example of the non-competitive industry. General Motors is recognized as the industry "price leader" in each price category, and can be seen as choosing each price in the way that maximizes its total corporate profits from the sale of automobiles. GM's competitors in each category may then be seen as accepting the price set by GM and competing on a non-price basis for various market shares. Recognizing its dominant position in the industry, GM has set its prices

based both on its average costs and on a variety of different levels of mark-up which depend importantly on the elasticity of demand for each different kind of car.

In order to solve this problem, we have divided total car sales into five distinct classifications: sub-compacts, compact, standard, intermediate, and luxury cars. We have then estimated the elasticity of demand for each of these classifications, taking into account the price of the class of car in question, the prices of cars which are close substitutes, and price of all cars in general. We would expect that the price elasticity is higher for smaller cars than for luxury cars and that it would be higher for closer substitutes. The results do in fact show just this. There is a particularly high cross-elasticity between standard and intermediate cars, which is quite understandable. As compact cars rise in price, some consumers might still prefer them to standard-size cars because of the ease of handling and parking or fuel economy. However, as the price of a standard car (such as Chevy) rises to and approaches the price of an intermediate (such as Pontiac) there are very few consumers who would not be willing to shift. The price elasticities for each size-price classification are given in Table II.

We now must calculate the change in price for a given change in marginal cost. This ratio depends on the cross-

Table II

Price Elasticities by Size-Price Classification

Class Number and Name	Total Price* Elasticity	Cross-Elasticity Relative to Substitutes (as Noted)		All Other Cars
1. Sub-compact	-4.1			
		Class 1	Class 3	
2. Compact	-5.4	-3.1	-2.3	
		Class 2	Class 4	
3. Standard-size regular	-5.7	-1.0	-4.7	
4. Intermediates	-1.8			-1.8
5. Luxury	-2.4			-2.4

*Calculated at mean values

elasticities given in Table II and also the change in elasticity as we move from one price to another. Since the demand for each class of cars depends in general on prices of all other cars as well as its own price, a complete set of simultaneous equations must be solved which take into account all of these relationships. In performing these calculations it should be noted that the change in cost per car is the same for all cars; hence the percentage increase is much greater for smaller cars than for larger ones. Thus in calculating these pass-along propositions, we also need to consider the ratio of the change in costs to the total price for each category as well as all the elasticity factors. We

would expect that the pass-along proportions would be high for higher price elasticities and lower prices. The final results, which are the percentage of the increased cost which is passed along as a higher price, are given in Table III

Table III

Pass-Along Proportions by Size-Price Classification

Class Number and Name	Change in Marginal Cost as a % of 1976 Price	Pass-Along Proportion of Price for Unit Cost Incr
1. Sub-compact	12.8	0.84
2. Compact	10.3	0.90
3. Standard-size regular	9.3	0.90
4. Intermediate	8.1	0.90
5. Luxury	5.4	0.98

IV. Changes in Demand

If we now know the change in price which will occur in each size-price classification because of the addition of various emission control devices, we can estimate the chan in sales. We have used a two-step procedure. We first es the share of the market for each size-price classification before and after the additional costs of the control equip These figures are given in Table IV.

It should be noted that 1973 (1975 if there are not y tion control standards) marks the introduction of what we called "Class Zero" cars -- sub-sub compacts. Trends of a mobile purchases during the last 15 years have been consi

Table IV

Shares of Total New Passenger Car Registrations
by Size-Price Category, Baseline and Impact:
1970-1980

	Category 1			2			3			4		
	Baseline	Impact	Dif.	B.	I.	D.	B.	I.	D.	B.	I.	D.
1970	.2012	.2012	.0000	.2468	.2468	.0000	.2570	.2570	.0000	.1983	.1983	.0000
1971	.1718	.1718	.0000	.2538	.2538	.0000	.2576	.2576	.0000	.2146	.2146	.0000
1972	.1438	.1438	.0000	.2667	.2667	.0000	.2644	.2644	.0000	.2187	.2187	.0000
1973	.1551	.1544	-.0007	.2665	.2674	.0009	.2573	.2542	-.0031	.2139	.2144	.0005
1974	.1667	.1662	-.0005	.2665	.2673	.0008	.2502	.2472	-.0030	.2079	.2083	.0004
1975	.1700	.1681	-.0019	.2666	.2696	.0030	.2440	.2318	-.0122	.2001	.2000	-.0001
1976	.1720	.1693	-.0027	.2667	.2711	.0044	.2374	.2200	-.0174	.1968	.1961	-.0007
1977	.1740	.1714	-.0026	.2667	.2709	.0042	.2305	.2137	-.0168	.1885	.1889	.0004
1978	.1760	.1734	-.0026	.2665	.2706	.0041	.2241	.2076	-.0165	.1789	.1803	.0014
1979	.1781	.1755	-.0026	.2664	.2704	.0040	.2172	.2010	-.0162	.1693	.1720	.0027
1980	.1800	.1775	-.0025	.2665	.2705	.0040	.2105	.1944	-.0161	.1611	.1637	.0026

	5			"Class Zero"		
	B.	I.	D.	B.	I.	D.
1970	.0967	.9067	.0000	.0	.0	.0000
1971	.1022	.1022	.0000	.0	.0	.0000
1972	.1064	.1064	.0000	.0	.0	.0000
1973	.1071	.1080	.0009	.0	.0016	.0016
1974	.1086	.1094	.0008	.0	.0016	.0016
1975	.1107	.1141	.0034	.0086	.0164	.0078
1976	.1117	.1175	.0058	.0154	.0260	.0106
1977	.1136	.1183	.0047	.0267	.0368	.0101
1978	.1157	.1201	.0044	.0388	.0480	.0092
1979	.1179	.1220	.0041	.0511	.0591	.0080
1980	.1198	.1238	.0040	.0621	.0701	.0080

tently in the direction of introducing new, smaller cars, and there is no reason why this should not continue. In fact, pollution standards as they now exist are likely to accelerate this move for two reasons. First, motorcycle-size engines are likely to emit pollutants which are within the required limits even if they are not as efficient as larger engines, simply because of the smaller size involved. Second, the major problem with catalysts developed to date has been that they do not last more than 10,000 or 15,000 miles. This suggests the emergence of very inexpensive automobiles which are not expected to last more than 10-15,000 miles and would be constructed with very inexpensive materials. Both the "motorcycles with roofs" and the "throwaway cars" are likely to be sold within the next five years, and by 1980 can be expected to have annual sales in excess of 7% of the total auto market.

After calculating the relative shares of the auto market, we then proceed to determine the size of the market itself. For this purpose we use the Chase Econometrics macroeconomic model to project the economic climate for the next ten years. In generating this projection we have used as an overall guideline the basic long-range forecasts made by the Council of Economic Advisers, which assumes that unemployment declines to 4 1/2% and stays there and inflation remains below 3% throughout the decade. We have not, for example, included here

the result of alternative runs incorporating a recession in 1974-1975. The levels of several key variables under these baseline assumptions, plus the predictions for total auto sales under the baseline and impact projections, are given in Table V.

Table V

Macroeconomic and Auto Sales Projections, 1970-1980

Year	GNP$	GNP	P	UN	NPCR Baseline	NPCR Impact
1970	974.1	720.0	116.3	5.0	8.44	8.44
1971	1050.3	741.9	121.2	5.9	10.32	10.32
1972	1147.1	785.7	124.8	5.4	11.17	11.17
1973	1266.8	836.1	129.8	4.9	11.91	11.83
1974	1374.2	875.5	135.5	4.7	12.37	12.30
1975	1477.7	906.6	141.5	4.8	12.68	12.36
1976	1608.0	952.8	147.0	4.4	13.31	12.89
1977	1742.6	996.2	153.0	4.4	13.60	13.27
1978	1881.3	1038.4	159.0	4.4	13.90	13.65
1979	2028.2	1083.4	164.6	4.4	14.24	14.04
1980	2182.1	1131.1	169.9	4.5	14.53	14.35

Where:

GNP$ = Gross national product, billions of current dollars
GNP = Gross national product, 1958 dollars
P = Consumer price index, 1967=100
UN = Rate of unemployment, %
NPCR = New passenger car registrations, millions

We can then combine the estimates of shares with the projections of total car market to generate predictions of auto sales by size-price classification with and without emission control standards. These results are given in Table VI.

From Table VI it can be seen that standard-size cars are the hardest hit because of their high price elasticity. Class I also drops substantially, as it loses ground to

55

both the sub-sub-compacts (which require cheaper emission control equipment) and the regular compacts (which have had a much smaller percentage increase in price). The other three classifications have a gain in market share but a drop in actual sales. As might be expected, the drop in luxury car sales caused by the control equipment is almost zero.

V. Macroeconomic Implications

We can also use the Chase Econometrics macroeconomic model to determine the effects which the imposition of emission control standards will have on output, prices, employment and international trade.

It cannot be stressed too strongly that these effects are largely a function of the state of the economy at the time when the emission control standards are instituted. If the economy is already in a recession, a further decline in aggregate demand will lead to greater unemployment and less output. If, on the other hand, the economy is at full employment, there may be a short-run decline in demand, but after a year or two the slack in automobile purchases will be filled by other components of aggregate demand. This transfer mechanism is likely to work through changes in relative product and factor prices, including wage rates and interest rates. Since we have been asked to prepare a baseline solution with the economy at full employment, this

Table VI

New Passenger Car Registrations by Size-Price Classification

Class I

	Baseline Registrations	Net Gain (Loss) Due to Change In Share	Net Loss Due To Decline In Total Market	Registrations After Emission Controls
1970	1.698	0	0	1.698
1971	1.773	0	0	1.773
1972	1.606	0	0	1.606
1973	1.847	-.007	-.013	1.827
1974	2.062	-.006	-.012	2.044
1975	2.156	-.024	-.054	2.078
1976	2.289	-.036	-.071	2.182
1977	2.366	-.035	-.057	2.274
1978	2.446	-.036	-.043	2.367
1979	2.536	-.036	-.036	2.464
1980	2.615	-.036	-.032	2.547

Class II

1970	2.083	0	0	2.083
1971	2.619	0	0	2.619
1972	2.979	0	0	2.979
1973	3.174	.010	-.021	3.163
1974	3.297	.010	-.019	3.288
1975	3.380	.037	-.085	3.332
1976	3.550	.057	-.113	3.494
1977	3.627	.057	-.089	3.595
1978	3.704	.057	-.067	3.694
1979	3.794	.056	-.054	3.796
1980	3.872	.058	-.048	3.882

Table VI (Cont'd)

Class III

	Baseline Registrations	Net Gain (Loss) Due to Change In Share	Net Loss Due To Decline In Total Market	Registrations After Emission Controls
1970	2.169	0	0	2.169
1971	2.658	0	0	2.658
1972	2.953	0	0	2.953
1973	3.064	-.036	-.021	3.007
1974	3.095	-.036	-.018	3.041
1975	3.094	-.155	-.074	2.865
1976	3.160	-.232	-.092	2.836
1977	3.135	-.288	-.071	2.836
1978	3.115	-.229	-.052	2.834
1979	3.093	-.231	-.040	2.822
1980	3.059	-.234	-.035	2.790

Class IV

1970	1.674	0	0	1.674
1971	2.215	0	0	2.215
1972	2.443	0	0	2.443
1973	2.548	.005	-.017	2.536
1974	2.572	.005	-.015	2.562
1975	2.537	-.001	-.064	2.472
1976	2.619	-.008	-.083	2.528
1977	2.564	.005	-.062	2.507
1978	2.487	.019	-.045	2.461
1979	2.411	.038	-.034	2.415
1980	2.341	.037	-.029	2.349

Table VI (Cont'd)

Class V

	Baseline Registrations	Net Gain (Loss) Due to Change In Share	Net Loss Due To Decline In Total Market	Registrations After Emission Controls
1970	.816	0	0	.816
1971	1.055	0	0	1.055
1972	1.188	0	0	1.188
1973	1.276	.011	-.009	1.278
1974	1.343	.011	-.008	1.346
1975	1.404	.042	-.036	1.410
1976	1.487	.076	-.048	1.515
1977	1.545	.063	-.038	1.570
1978	1.608	.060	-.029	1.639
1979	1.679	.058	-.024	1.713
1980	1.741	.058	-.022	1.777

is approximately what happens, as explained next.

In 1976, when the maximum costs of emission control standards first go into effect, auto sales are 400,000 units lower with controls then without. However, there are offsetting increases. Because unemployment is slightly higher and capacity utilization is slightly lower in the impact case, prices do not rise as fast (the CPI rises 3.85% compared to 3.90% in the baseline case). As a result, non-auto consumption declines less than would otherwise be the case, residential construction rises slightly, and government expenditures in constant dollars are higher because the same number of dollars can purchase more goods and services at lower prices. These changes tend to offset the decline due to the reduction in auto production. Thus by 1980, total employment (and unemployment) are the same under either the baseline or impact projection. This is the correct way to interpret the full employment assumption under which these runs are calculated.

The net foreign balance, however, does suffer significantly. After emission control standards are set, there will be a substantial increase in sales of sub-sub-compact cars, and most of these will be foreign produced. Thus, imports will rise substantially and will more than offset the slight rise in exports which occurs because non-auto prices are slightly lower. In any case, this effect will be less than $1 billion.

The baseline and impact effects are compared for several key variables in Table VII.

VI. Industry Implications

As pointed out in the previous section, the effects on the economy from the imposition of emission control standards work in opposite directions. Clearly a decrease in automobile production will lower employment and shipments in supplier industries, on the other hand, increases in other consumption and investment will counteract these declines in many of the same industries. These two effects are offsetting by 1980 for most industries providing that we continue to operate in a full-employment environment. Thus it can be seen from Table VIII that constant-dollar sales (i.e., volume) increases in most of the supplier industries by 1980. The same pattern is shown for employment for these industries in Table IX.

While these results may seem somewhat paradoxical, they are the direct result of the assumption that the economy is at full employment. With unemployment under 4 1/2%, there are many alternative uses for the factor resources which are idled by the decline in automobile demand. While there is an undeniable drop in auto sales, employment and profits, these are balanced in the aggregate by increases elsewhere. If on the other hand these new

TABLE VII.

Macroeconomic Effects of Emission Control Standards

	GNP$ B	GNP$ I	Diff.	GNP	GNP	Diff.	CPI	CPI	Diff.	Emply.	Emply.	Diff.
1971	1050.3	1050.3	0.0	741.9	741.9	0.0	121.2	121.2	0.0	18.59	18.59	0
1972	1147.1	1147.1	0.0	785.7	785.7	0.0	124.8	124.8	0.0	18.79	18.79	0
1973	1266.8	1266.5	-0.3	836.1	835.9	-0.2	129.8	129.9	+0.1	19.27	19.26	-.01
1974	1374.2	1373.5	-0.7	875.5	875.1	-0.4	135.5	135.5	0.0	19.54	19.52	-.02
1975	1477.7	1476.3	-1.4	906.6	906.0	-0.6	141.5	141.6	+0.1	19.50	19.45	-.05
1976	1608.0	1604.7	-3.3	952.8	951.5	-1.3	147.0	147.0	0.0	20.01	19.93	-.12
1977	1742.6	1738.2	-4.4	996.2	995.7	-0.5	153.0	152.7	-0.3	20.37	20.31	-.06
1978	1881.3	1877.1	-4.2	1038.4	1039.7	+1.3	159.0	158.4	-0.6	20.63	20.60	-.03
1979	2028.2	2024.5	-3.7	1083.4	1086.0	+2.4	164.6	163.9	-0.7	20.92	20.92	0
1980	2182.1	2178.5	-3.6	1131.1	1134.3	+3.2	169.9	169.1	-0.8	21.23	21.23	0

	UN	UN	Diff.	NFB	NFB	Diff.
1971	5.94	5.94	0	1.0	1.0	0
1972	5.44	5.44	0	3.5	3.5	0
1973	4.94	4.95	+.01	3.7	3.6	-0.1
1974	4.71	4.72	+.01	1.8	1.7	-0.1
1975	4.76	4.81	+.05	1.3	0.9	-0.4
1976	4.41	4.46	+.05	0.7	0.2	-0.5
1977	4.37	4.40	+.03	-0.6	-1.0	-0.4
1978	4.43	4.43	0	-0.5	-0.9	-0.4
1979	4.42	4.41	-.01	1.3	0.8	+0.5

Table VIII.

Industry Performance: 1970-1980

Variable	Industry SIC	Assumption	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Sales FTC-SEC, Constant $	371	Baseline	50.24	59.36	66.63	71.68	74.05	75.25	81.55	83.04	84.93	87.84	90.42
		Impact(100%)	"	"	"	71.38	73.82	74.22	80.22	82.27	84.52	90.05	90.05
		Difference	0	0	0	-.30	-.23	-1.03	-1.33	-.77	-.41	-.32	-.37
	331, 332 339		23.96	23.35	26.12	29.52	29.99	29.33	31.09	32.48	32.95	33.68	34.75
			"	"	"	29.46	29.91	29.13	30.76	32.30	32.98	33.85	34.88
			0	0	0	-.06	-.08	-.20	-.33	-.18	.05	.17	.15
	333, 334 335, 3392		16.81	17.09	18.91	21.19	21.99	22.05	23.49	24.50	25.18	26.09	27.20
			"	"	"	21.16	21.96	21.96	23.34	24.43	25.25	26.22	27.32
			0	0	0	-.03	-.03	-.09	-.15	-.07	.07	.13	.12
	34		30.95	32.41	35.75	39.41	41.63	43.36	47.04	49.78	52.35	55.36	58.53
			"	"	"	39.38	41.59	43.27	46.89	49.74	52.47	55.59	58.78
			0	0	0	-.03	-.04	-.11	-.15	-.04	.12	.23	.25
	35		50.81	48.67	53.88	61.11	65.73	67.62	72.54	76.79	79.75	83.42	87.42
			"	"	"	61.07	65.64	67.44	72.17	76.56	79.82	83.73	87.80
			0	0	0	-.04	-.09	-.18	-.37	-.23	.07	.31	.38
	36		66.83	69.46	80.35	93.38	101.10	106.07	117.26	127.39	136.14	146.59	158.47
			"	"	"	93.32	100.98	105.83	116.76	127.17	136.45	147.20	159.03
			0	0	0	-.06	-.12	-.24	-.50	-.22	.31	.61	.56
	22		20.85	22.26	24.28	26.16	27.79	28.62	30.67	32.05	33.41	34.95	36.58
			"	"	"	26.14	27.78	28.56	30.58	32.06	33.51	35.09	36.73
			0	0	0	-.02	-.01	-.06	-.09	.01	.10	.14	.15
	23		19.83	20.08	22.02	24.15	25.75	26.39	28.04	29.26	30.36	31.55	32.83
			"	"	"	24.13	25.73	26.34	27.95	29.23	30.45	31.68	32.99
			0	0	0	-.02	-.02	-.05	-.09	-.03	.07	.13	.16
	28		56.92	58.98	66.05	72.57	76.80	78.79	84.65	87.83	91.47	95.84	100.66
			"	"	"	72.53	76.76	78.69	84.51	87.92	91.84	96.36	101.20
			0	0	0	-.04	-.04	-.10	-.14	.09	.37	.52	.54
	30		15.35	16.20	17.56	18.58	18.50	17.96	19.19	19.26	19.64	20.21	21.00
			"	"	"	18.56	18.48	17.89	19.13	19.33	19.80	20.40	21.17
			0	0	0	-.02	-.02	-.07	-.06	.07	.16	.19	.17
	32		15.50	15.83	17.89	19.73	20.53	21.35	23.33	24.77	26.05	27.52	28.99
			"	"	"	19.71	20.51	21.30	23.25	24.77	26.15	27.66	29.03
			0	0	0	-.02	-.02	-.05	-.08	0	.10	.14	.13
	29		63.40	67.96	73.39	80.05	84.75	88.31	94.20	98.88	103.61	109.02	114.96
			"	"	"	80.03	84.72	88.26	94.12	98.94	103.88	109.44	115.43
			0	0	0	-.02	-.03	-.05	-.08	.06	.27	.42	.47

Table VIII (Cont'd)

Effect on Shipments for Supplier Industries

Variable	Industry I/O	Assumption	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Shipments, Constant $	41	Baseline	7.78	8.31	8.98	9.79	10.43	10.90	11.65	12.27	12.86	13.53	14.25
		Impact (100%)	"	"	"	9.78	10.41	10.84	11.56	12.21	12.83	13.53	14.26
		Difference	0	0	0	-.01	-.02	-.06	-.09	-.06	-.03	0	.01
	47		5.35	5.38	6.06	6.99	7.43	7.49	8.02	8.46	8.69	9.00	9.37
			"	"	"	6.98	7.42	7.46	7.96	8.43	8.70	9.05	9.42
			0	0	0	-.01	-.01	-.03	-.06	-.03	.01	.05	.05
	49		6.67	6.71	7.62	8.86	9.38	9.38	10.06	10.67	10.95	11.35	11.81
			"	"	"	8.85	9.37	9.35	10.00	10.61	10.99	11.43	11.92
			0	0	0	-.01	-.01	-.03	-.06	-.03	.04	.08	.08
	50		3.12	3.18	3.38	3.68	3.89	4.04	4.30	4.51	4.70	4.92	5.16
			"	"	"	3.67	3.88	4.01	4.26	4.49	4.69	4.95	5.17
			0	0	0	-.01	-.01	-.03	-.04	-.02	-.01	.01	.01
	58		3.11	3.17	3.51	3.90	4.01	3.99	4.25	4.46	4.57	4.71	4.88
			"	"	"	3.90	4.00	3.96	4.21	4.41	4.57	4.72	4.89
			0	0	0	.0	-.01	-.03	-.04	-.02	0	.01	.01
	17		6.08	6.87	7.55	8.35	9.11	9.72	10.56	11.37	12.20	13.09	14.03
			"	"	"	8.35	9.10	9.71	10.54	11.36	12.22	13.13	14.12
			0	0	0	0	-.01	-.01	-.02		.02	.01	.01
	19		4.06	4.43	4.79	5.22	5.60	5.82	6.20	6.52	6.85	7.16	7.52
			"	"	"	5.21	5.59	5.80	6.17	6.50	6.84	7.18	7.54
			0	0	0	-.01	-.01	-.02	-.03	-.02	.01	.02	.02
	28		15.30	14.87	17.53	19.86	21.54	22.35	25.63	27.43	29.49	32.01	34.81
			"	"	"	19.84	21.43	22.47	25.52	27.45	29.61	32.19	34.95
			0	0	0	-.02	-.01	-.08	-.11	.02	.15	.15	.14
	30		2.67	2.92	3.18	3.48	3.56	3.57	3.75	3.91	4.09	4.11	4.24
			"	"	"	3.47	3.56	3.56	3.73	3.90	4.01	4.12	4.25
			0	0	0	-.01	0	-.01	-.02	-.01	.01	.01	.01
	35		3.86	4.00	4.41	4.86	5.06	5.13	5.41	5.69	5.86	6.06	6.30
			"	"	"	4.85	5.05	5.11	5.40	5.67	5.87	6.08	6.31
			0	0	0	-.01	-.01	-.02	-.01	-.02	.01	.02	.01

Table IX

Effect on Employment for Supplier Industries

Variable	Industry SIC	Assumption	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total Employment (1000's)	371	Baseline	810	889	941	973	982	979	1025	1029	1031	1040	1044
		Impact	810	889	941	969	979	966	1007	1014	1020	1030	1035
		Difference	0	0	0	-4	-3	-13	-18	-15	-11	-10	- 9
	331,332 339		855	820	832	882	916	936	987	1040	1071	1105	1143
			855	820	832	880	914	932	980	1035	1070	1106	1145
			0	0	0	-2	-2	- 4	- 7	- 5	- 1	1	2
	333,334,335, 336,3392		451	421	419	444	452	453	477	503	523	546	573
			451	421	419	444	450	452	474	501	523	548	575
			0	0	0	0	-2	- 1	- 3	- 1	- 3	2	2
	34		1386	1336	1366	1410	1424	1431	1481	1511	1538	1574	1613
			1386	1336	1366	1410	1423	1429	1476	1509	1540	1578	1618
			0	0	0	0	-1	-2	- 5	- 2	2	4	5
	35		1964	1786	1906	2137	2308	2400	2549	2686	2785	2896	3016
			1964	1786	1906	2136	2306	2398	2543	2682	2788	2906	3029
			0	0	0	-1	-2	-2	- 6	- 4	3	10	13
	36		1913	1785	1855	1993	2024	2021	2141	2254	2348	2478	2639
			1913	1785	1855	1992	2022	2017	2134	2251	2353	2489	2650
			0	0	0	-1	-2	-4	- 7	-3	5	11	11
	22		965	949	971	1000	1018	1018	1035	1048	1056	1066	1079
			965	949	971	999	1017	1016	1034	1048	1058	1069	1082
			0	0	0	-1	-1	-2	- 1	0	2	3	3
	23		1385	1425	1468	1533	1591	1615	1656	1693	1723	1753	1788
			1385	1425	1468	1533	1590	1614	1653	1690	1725	1758	1795
			0	0	0	0	-1	-1	-3	- 3	2	5	7
	28		1057	1015	1047	1101	1151	1191	1244	1295	1342	1392	1444
			1057	1015	1047	1101	1151	1190	1243	1294	1342	1393	1447
			0	0	0	0	0	-1	-1	- 1	0	1	3
	30		571	583	647	723	785	834	902	950	997	1045	1093
			571	583	647	722	785	832	900	950	998	1047	1097
			0	0	0	-1	0	-2	-2	0	1	2	4
	32		638	627	640	661	665	668	690	704	714	725	738
			638	627	640	661	665	668	690	704	716	728	741
			0	0	0	0	0	0	0	0	2	3	3
	29		192	191	186	182	176	172	168	162	157	153	147
			192	191	186	182	176	172	168	162	157	153	147
			0	0	0	0	0	0	0	0	0	0	0

standards were added during the time of a recession, the effects would be much more severe, although they too could be offset by stimulatory fiscal and monetary policy.

VIII. Conclusion

The institution of mobile source emission control standards will reduce auto sales by a maximum of 400,000 units in 1976, with almost all of the decrease centering in the sub-compact, compact and standard sized cars. This will reduce employment in the auto industry by about 20,000 workers and profits by approximately $150 million.

The effects on the rest of the economy are modest. Since we are assuming that the economy will be at full employment during the period 1976-1980, the decrease in auto sales will be offset by the decline due to lower demand and hence lower wage and price increases. There will be some deterioration in net exports because sub-sub-compact cars, which will probably be of foreign manufacture, will increase substantially. However, foreign trade will not be harmed nearly as much as could be the case for other industries saddled with stringent pollution control requirements for two reasons. First, foreign cars will be subject to the same control standards, so that imports (except for sub-sub-compacts) will not gain any additional competitive advantage. Second, either other countires will institute similar controls, thus compensating

for the price increase of our exports, or U.S. auto companies will produce cars for export which do not contain the emission control equipment.

There are, of course, many unanswered questions which have been raised by this study, some of which have already been mentioned in earlier sections of this summary. What form will the market for sub-sub-compacts (or mini-cars) actually take, and will it be primarily a domestic or foreign industry? What about the interrelationships with the petroleum industry; how will the reduced fuel economy affect the demand for fuel, the refining structure, and marketing methods of the petroleum companies? How will the increased price of cars affect the demand for mass transportation systems, and how will these systems be financed? While these questions must be answered and the interrelationships explored before any definitive answer can be given about the effect of emission control standards, the results of this study would suggest at a minimum that the strictly economic effects of an additional rise in costs of approximately $300 per car by 1976 will not have severe effects on the domestic automobile industry.